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January 19, 1995

VIA MESSENGER

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222, Stop Code 1170
Washington, D.C. 20554

Re: ET Docket No. 94-32
Ex Parte Presentation

Dear Mr. Caton:

In accordance with the Commission's rules, this is to serve notice that on January 18, 1995, representatives of International Business Machines Corporation ("IBM") met with Robert Pepper, Donald Gips, Mark Corbitt, and John Williams of the Office of Plans and Policy to discuss matters raised by the comments filed in the above-referenced proceeding. At this meeting, IBM demonstrated wireless LAN technology that operates in the 2402-2417 MHz band that is a subject of this proceeding.

IBM was represented by Sheila McCartney, Paul Ellinghaus, Randy Bowling, and Glynn Furr, of IBM, as well as William Richardson and the undersigned, of Wilmer, Cutler & Pickering. The materials provided at this meeting are attached hereto.

Sincerely,

Lynn R. Charytan

cc: Robert Pepper
Donald Gips
Mark Corbitt
John Williams

IBM POSITION POINTS FOR ISM MEETINGS

* In response to Commission encouragement, IBM has spent many millions of dollars and man hours developing and marketing Part 15 spread spectrum wireless LAN adapters and other products for operation in the 2400 MHz band.

* Part 15 technology is used in wireless LANs, cordless telephones, wireless security systems and barcode readers, and countless other home, business, and manufacturing applications. As the technology has developed, newer and less expensive devices have become more accessible to individual consumers as well as schools, hospitals, libraries, and other public institutions.

* Reallocating the 2402-2417 MHz band to licensed uses would be devastating to Part 15 devices because that is the section of the 2400 MHz band least congested by ISM devices, and IBM's Part 15 products depend on this "sweet spot" in the band for maximum throughput and efficiency.

* Congestion or elimination of the 2402-2417 MHz band could require either recall or redesign of Part 15 technology operating in the 2400 MHz band, with disastrous consequences both for users and manufacturers.

* There is no benefit to be realized from reallocation, because no party has proposed a licensed use for the 2402-2417 MHz band that has been shown to be capable of coexisting with its incumbent uses, including ISM and Part 15.

* Most importantly, reallocating the band to licensed uses presents fundamental policy concerns:

    * Reallocation will interfere with the development and availability of important new technologies that are forming a vital part of the National Information Infrastructure and promising to bring important communication advances to universities, hospitals and libraries.

    * Interfering with established Part 15 use of the band would send a message that investments in new information technology and products carry unacceptable regulatory risks.

    * Eliminating the 2402-2417 MHz segment of the band domestically will make it difficult for manufacturers to generate the volume necessary to produce equipment for export, thereby eliminating that substantial market for U.S. firms.

IBM Meeting with FCC Office of Plans and Policy

January 18, 1995

Agenda:

* View of Wireless Marketplace

* Wireless Product Discussion and Demo

* Discussion on NPRM

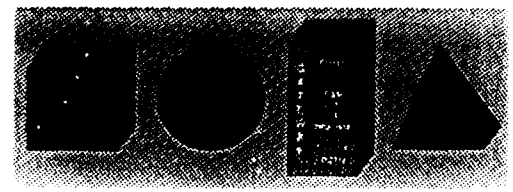
Objectives:

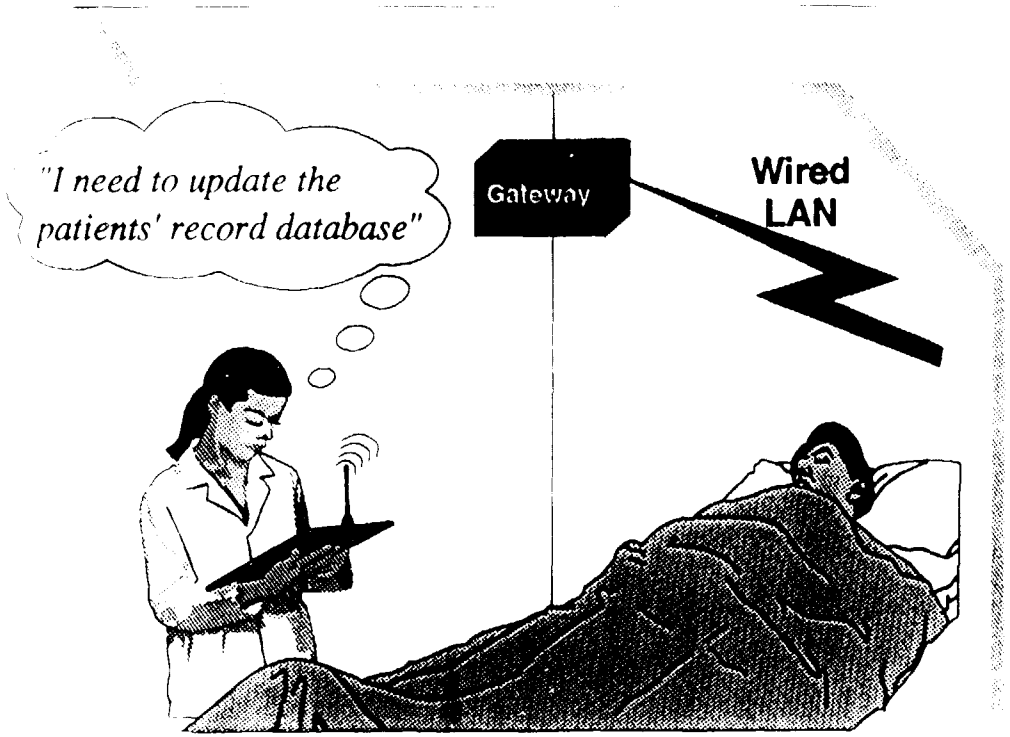
* Share Information on Wireless LAN Market

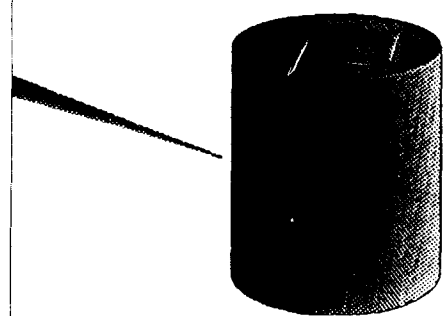
* Demonstrate Capabilities of Part 15 Radio LAN

* Understand & Discuss FCC Position on 2402-2417

What is a LAN?







Server
Patient
Record

Mobile Clients: *PDAs/PCAs, Notebooks, Pen-Based*

Wireless Network: *Infrared (Direct, Diffused)*
RF (CSMA/CA, TDMA)

Application/Services: *Traditional LAN with mobility, ad-hoc networks, wire alternatives*

Wireless LAN Analysis

- **New adapters that operate at 2.4 GHz will drive worldwide market acceptance**
  - This will accelerate user adoption and drive down costs
  - In 1994, almost half of AT&T's shipments are overseas
- **Increased competition will drive prices down and increase market awareness and adoption**
  - Over 20 vendors have announced wireless LANs
  - Motorola, 3Com and Toshiba will announce new products by 1Q95
- **Most wireless LAN growth will be driven by traditional LAN applications**
  - Pent-up demand within (finance, health, retail...) to give employees mobility
  - New applications such as Ad-hoc workgroups and "wiring alternatives" are new revenue opportunities

IBM Wireless LAN Overview

Strategy:

* Lead Wireless LAN Data Market
  - Enter Market with Broad Offering
  - Build RF Skills
  - Improve IBM Content with Technology Investments
  - Lead Price/Function Curve to Sustain Market Leadership
  - Diversify to Provide Adapters for DECT.....

Investments:

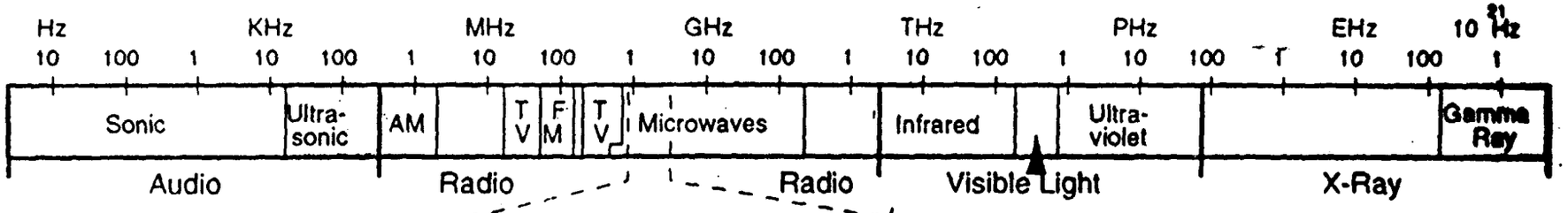
* IBM Wireless LAN Advanced
* IBM Wireless LAN Entry
* AS/400 Wireless LAN
* Complementary Products Portable Devices

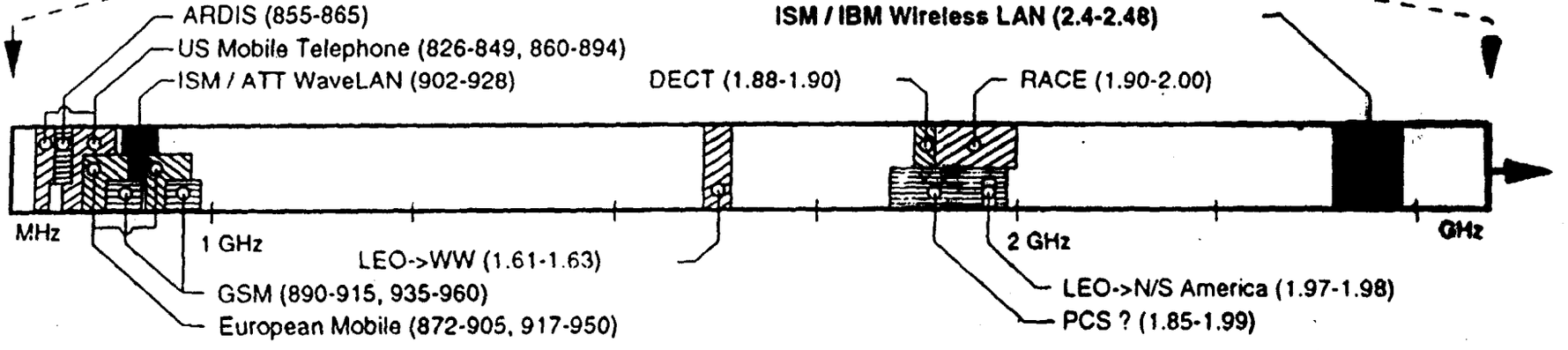
Anticipate Return on Investments

Additional Planned Research and Development

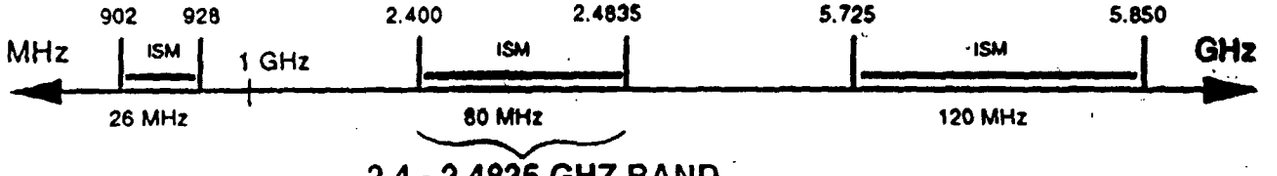
* Radio Skills
* VLSI
* Range
* Speed
* Roaming
* Cost/Price
* Operating Sys

FREQUENCY SPECTRUM (U.S. and Europe)





License-Free RF Bands



2.4 - 2.4835 GHZ BAND

- **No FCC or Country Licensing Required**
- **Only Band Available in Nearly Every Country**
- **Greater Bandwidth than 902-928 MHz Band**
- **Much Less Crowded than 902-928 MHz Band**

IBM WIRELESS LAN DESCRIPTION

LAN ADAPTER
- Desk-top's: ISA/MCA Bus
- Portables: PCMCIA type II
- Same adapter for base or remote's

2.4 GHz BAND (World-wide, unlicensed)

1 MBPS DATA RATE

SPREAD SPECTRUM, FREQUENCY HOPPING

INTELLIGENT SPECTRUM MANAGEMENT

TDMA PROTOCOL

DATA COMPRESSION

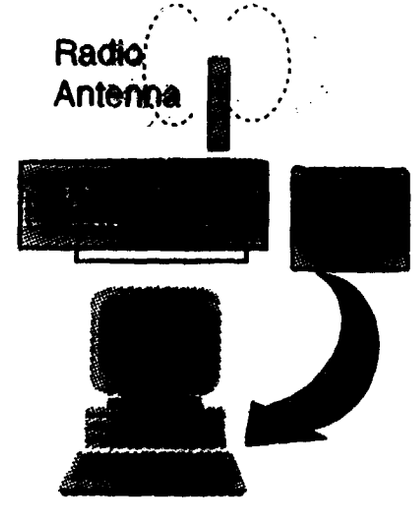
STRONG SECURITY
- Access control and encryption

360 M / 1200 Ft open space cell size

UP TO 50 USERS PER CELL

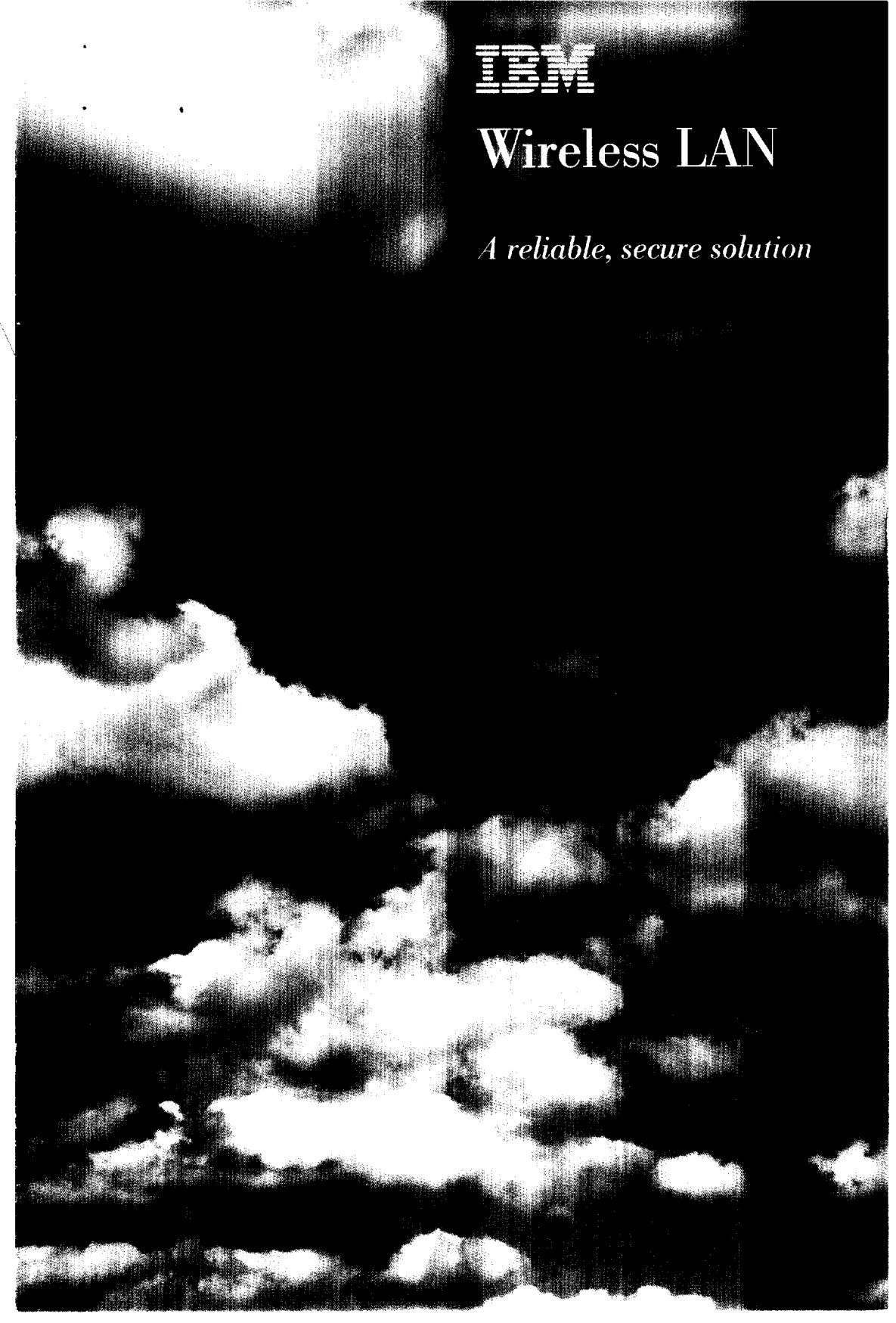
MULTIPLE CELL OVERLAP

WIRED LAN COMPATIBILITY
- T/R, E/N, PC NET
- NetBios, IPX, TCP/IP
- SNA / 3270 emulation
- IBM LAN Server, NOVELL NetWare
- Network Management/SNMP



DESK TOP SYSTEM

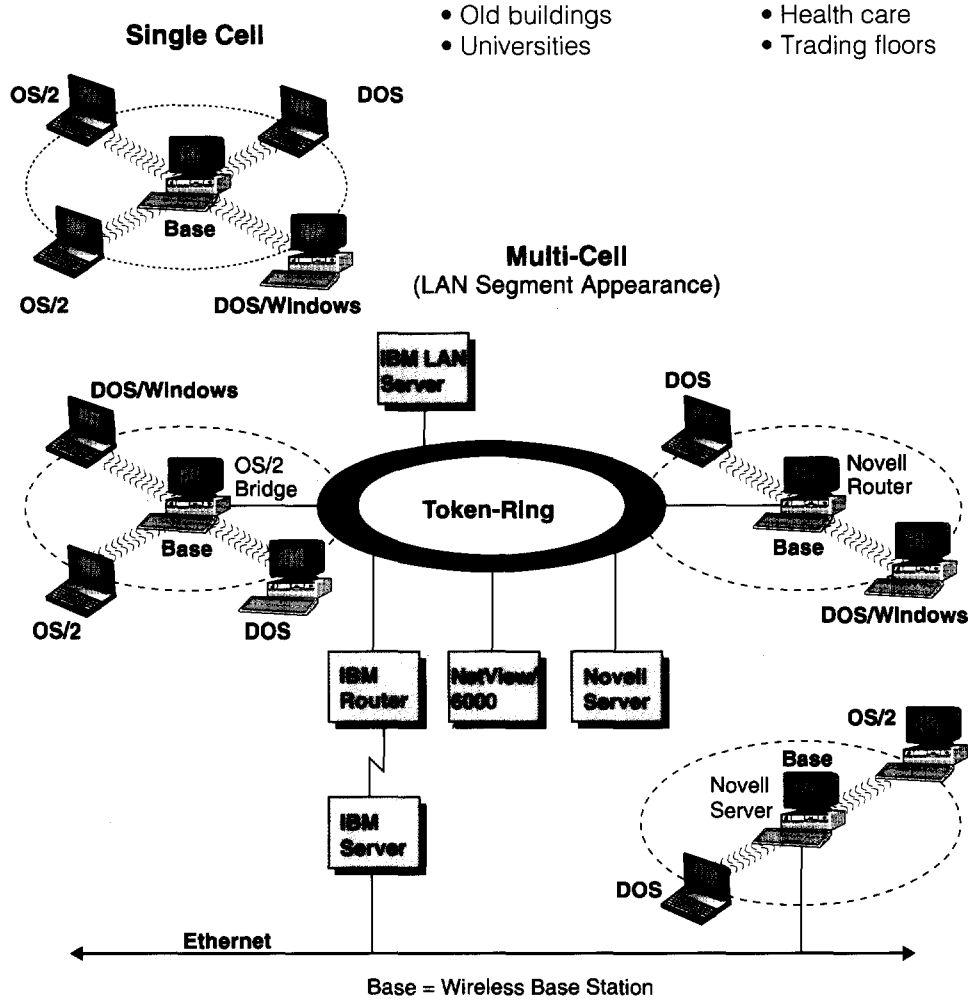
PORTABLE SYSTEM


IBM
Wireless LAN
A reliable, secure solution

A new solution for local networking

The IBM Wireless LAN is a local area network (LAN) system that allows the interconnection of LAN stations without cabling. It complements wired LANs, providing installation flexibility, user mobility, and cost savings in difficult cabling situations. The IBM Wireless LAN is made of adapters installed within personal systems, either with ISA or MCA bus or with PCMCIA feature slots. Put flexibility and mobility in your LAN and save on your wiring costs for:

- Office changes
- Temporary offices
- Old buildings
- Universities
- Leased facilities
- Mobile workforce
- Health care
- Trading floors



Base = Wireless Base Station

New IBM technology: reliable wireless communications

Interference avoidance

The IBM Wireless LAN uses "spread spectrum" radio with frequency hopping and intelligent spectrum management. Single frequency sources, such as microwave telephone links or microwave ovens, are avoided. Coexistence with other wireless networks is arranged by selecting proper frequency patterns.

Transmission reliability

Antenna diversity copes with multipath radio signals. The capability to overlap several radio cells permits a full coverage of complex floor layouts, even around obstacles.

Low power

With a low transmit power (100 mW) and power management on the PCMCIA adapter version, portable computers using Wireless LAN can stay connected longer.

Seamless wireless network

The IBM wireless network supports a large number of wireless cells, all interconnected via the wired LAN into one wireless network. Once registered in the network, a mobile user can access the network at any point within the radio coverage.

Consistent performances in small and large networks

Communication between stations uses a Time Division Multiplexing protocol. This allows distribution of cell capacity between the stations according to their actual needs, avoiding uncontrolled traffic interference. A cell can handle a large number of stations and still maintain the aggregate throughput.

Several cells may overlap, without affecting the throughput of each, thus multiplying the aggregate capacity of the network within the same area. This capability to create overlapping cells permits the allocation of more capacity to each station. This could be the case of a large conference room with hundreds of attendants using portable computers.

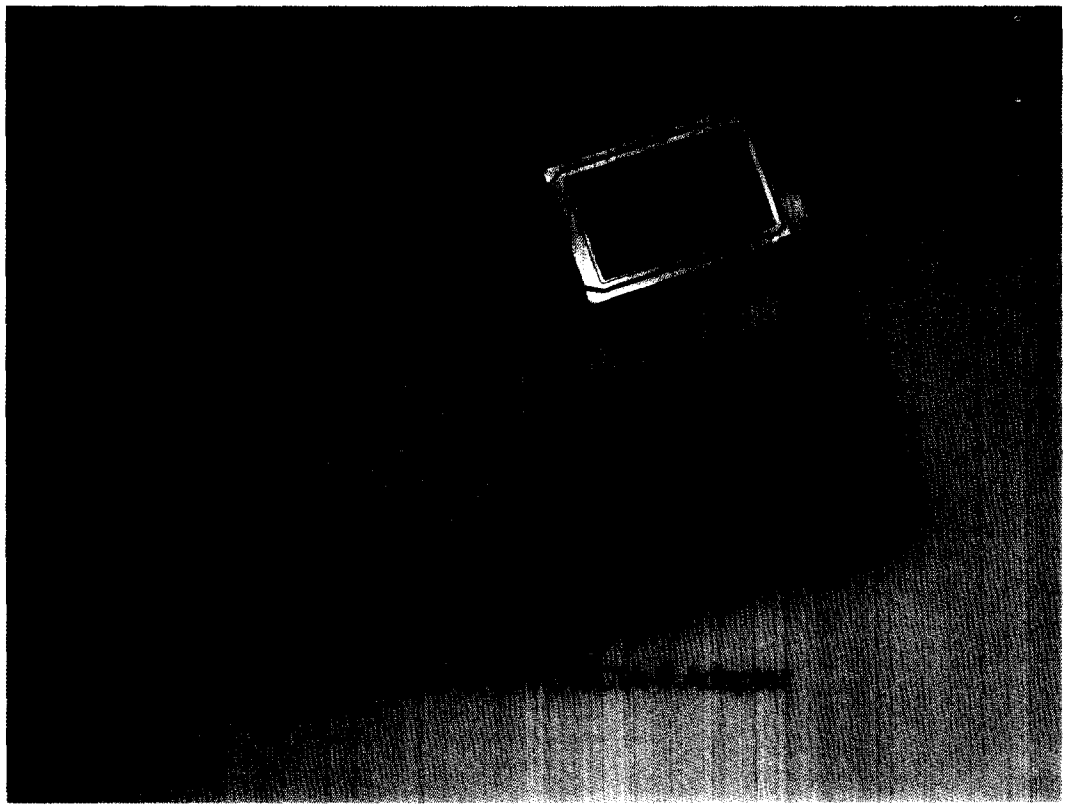
Security

Access control and data encryption

First, casual listeners are avoided because of the fairly complex radio modulation scheme. Second, network intrusion is prevented by an access control and station authentication mechanism. Finally, data is encrypted for radio transmission.

Safety

Low radio transmit power reduces any health hazard for Wireless LAN users. Based on current standards for protection against electromagnetic radiations, the power density around an IBM Wireless LAN is several hundred times below the recommended power density in uncontrolled environments.



IBM Wireless LAN ISA/MCA Adapter

IBM Wireless LAN specifications

Product

PCMCIA type II adapter (Right-Top)
ISA/MCA adapter (Right-Bottom)

Radio

Frequency	2.4 - 2.485 GHz
Transmit power	100 mW
Modulation	GFSK
Transmission mode	SS, FH
Signaling bit rate	1 Mbps
Data compression	Built-in
Encryption	Built-in
Standards	ETSI-RES 2
Cell size (open space)	360 meters (1200 feet)
Number of users per cell	50 connected
Number of overlapping cells	20

Hardware requirements

Wireless base	• IBM PS/2 or compatible PC system with a 386 or higher processor and 8 MB RAM, a hard disk, and a diskette drive • An available ISA or MCA adapter slot (can be shared with other applications such as a LAN server)
Wireless station	• IBM PS/2 or compatible PC system with a 286 or higher processor and 2 MB RAM, a hard disk, and a diskette drive (unless RIPL) • An available ISA, MCA, or PCMCIA adapter slot

Software requirements

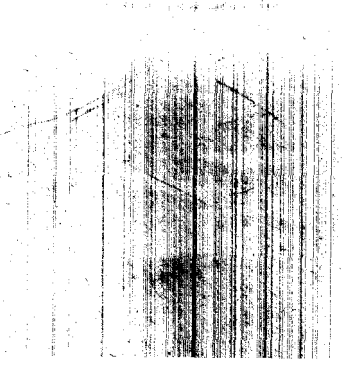
Wireless base	IBM OS/2 2.1 and LAN Server 3.0 or Novell NetWare 3.11 or higher
Remote (clients)	OS/2 2.1, or DOS 5 with or without Windows 3.1

Networking compatibility

Device drivers	NDIS, ODI
LLC	802.2
LAN types	Token-ring, Ethernet, PCNet
Protocols	NetBIOS, IPX, TCP/IP
LAN operating systems	• IBM LAN Server • Novell NetWare
Wired LAN connectivity	• Bridging to token-ring with OS/2 wireless base stations • Routing with NetWare base stations and with OS/2

Power

Adapter requirements (PCMCIA version)	700 mW
Radiated power in transmit mode at 30 cm (1 foot)	.008 mW/cm2 max recommended .5 mW/cm2 (ANSI C151/IEEEC95.3)



Flexible configurations fit in existing environments

Stand-alone wireless LAN

The wireless base station is housed in the server.

Wireless extensions of wired LAN

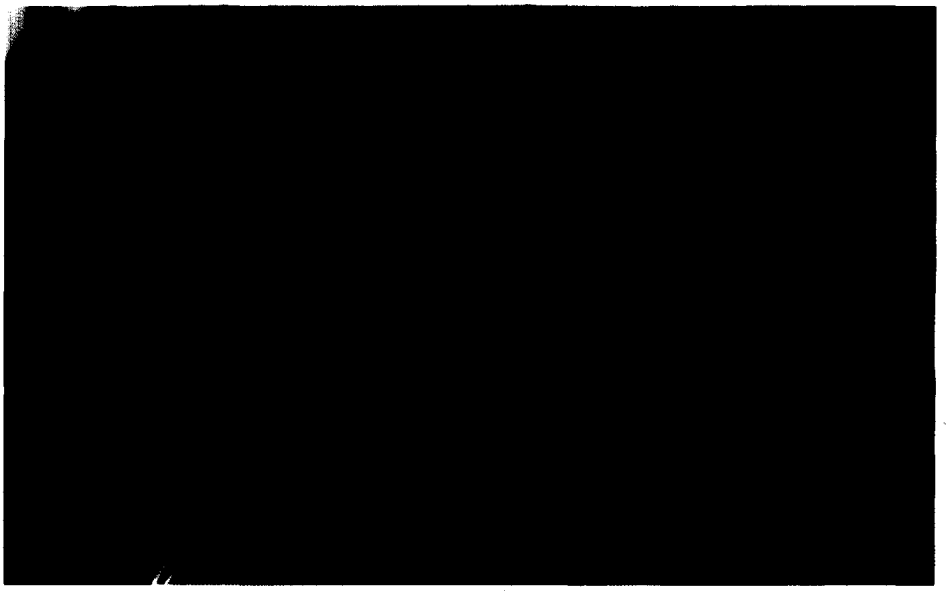
Each wireless cell is attached to the wired LAN via the wireless base.

Connectivity with wired LAN

Built-in bridge function for token-ring (OS/2 base). Routing function for Ethernet or token-ring supporting NetBIOS, IPX, and TCP/IP.

Compatible with most current LAN operating systems

- IBM LAN Servers
- Novell NetWare



Minimum infrastructure

One adapter for all functions

A full network is built with just one adapter type. The IBM Wireless LAN adapter can be configured as a remote station (client) or as a wireless base station with or without wired LAN connectivity. The adapter for wireless base can be housed in one of the network stations (with OS/2) or with a NetWare Server station.

Desktop or portable

The adapter is available in two card versions:

- Dual bus ISA/MCA card for desktop or floor-standing
- PCMCIA type II credit card

A short cable connects the card to the radio-antenna module.

Network management

SNMP interface

The IBM Wireless LAN allows support from NetView/6000 or other SNMP-based management platform.

Built-in administration tools

The wireless network administrator function, provided with the adapter, may be housed in a wired LAN administrator station. It allows the administrator to perform tasks such as new station registration at installation time, security control, and frequency management.

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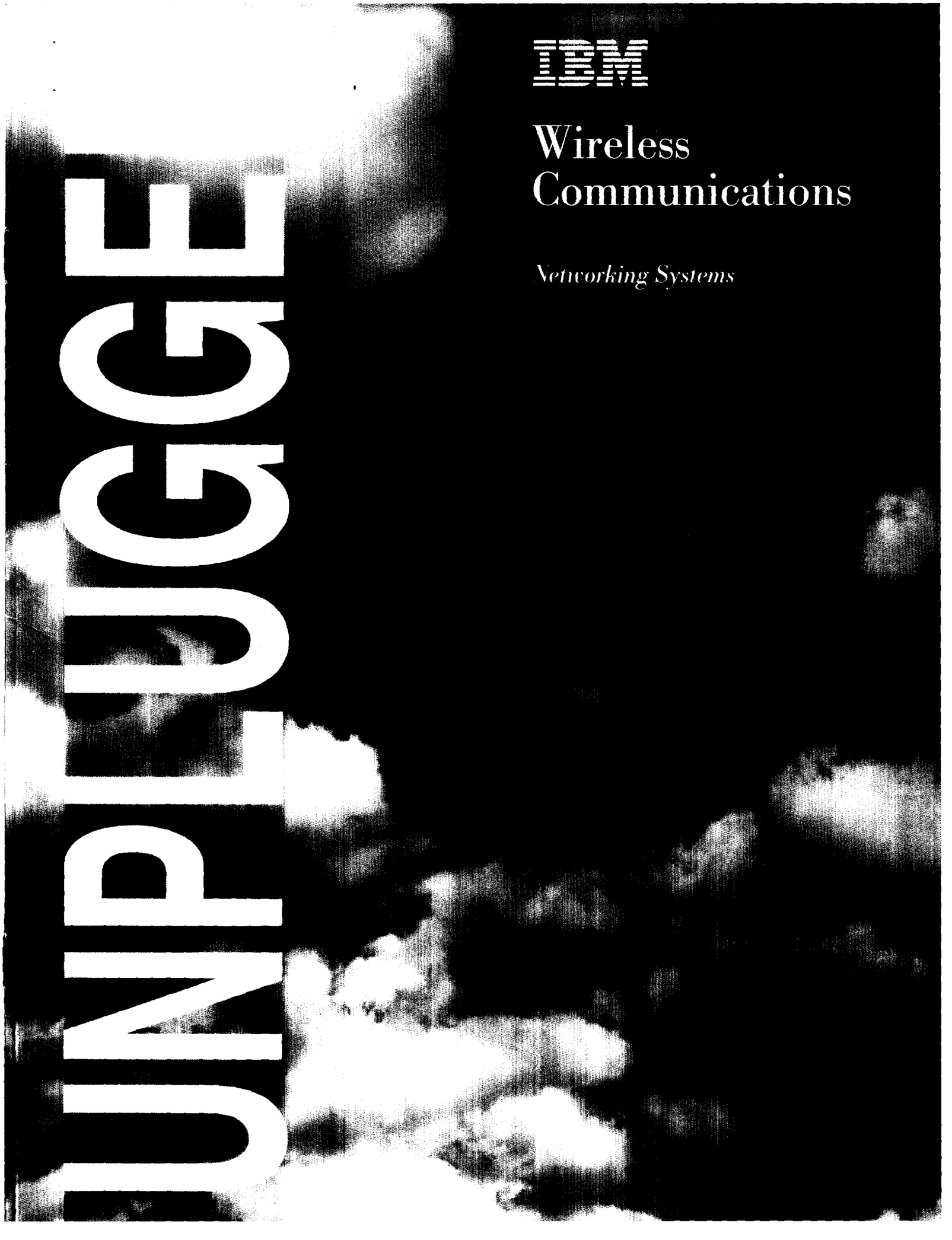


IBM

Wireless Communications

Networking Systems

WIRELESS COMMUNICATIONS

"We estimate that there will be 13 million wireless data users by the year 2000 . . . this is twice the growth rate of cellular voice," says Lee Franklin, President of PacTel.

Market forces are placing new demands on businesses. People spend more time away from their offices, yet they still need to be able to communicate effectively with people and to access their information resources. Wireless communications is a preferred solution to these changing business dynamics.

More and more employees are out of the office, roaming around the campus, traveling within the city, or on business trips. As a result, companies need to effectively manage the one thing that is considered to be critical for a competitive advantage . . . time.

Your business can manage time more efficiently with wireless communications. The benefits include:

- ✓ Quicker response time, by remote access of information via fax, voice, and data
- ✓ Increased customer satisfaction, by responding to their questions and satisfying their requirements

Your traveling executives, professionals, and sales and service personnel need to be able to access information easily. They need to have an easy-to-use "information appliance" to do that. Wireless communications can provide that ability for your employees.

There are many wireless products, technologies, and services to choose from. As with many new technologies, the large number of new terms and choices can be confusing.

This brochure introduces you to the choices and mix of wireless technologies available to you. It gives an overview of emerging wireless technologies and provides information about their benefits. The key is to have the appropriate combination of applications, equipment, and services for your needs. After reviewing this brochure, you can have an understanding of alternatives and a sense of direction about which alternatives to pursue.

Types of wireless solutions

It is unlikely that one data, fax, or voice network is well suited for all types of businesses. You might need a wireless solution that covers just your office building. Or you might want one that lets your traveling employees communicate with the main office, no matter where they are.

There are two basic types of wireless network solutions:

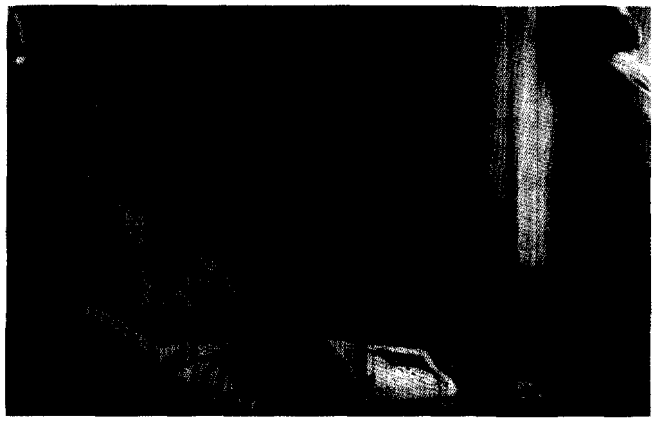
- ○ Wireless local area networks (LANs)
- ○ Wireless wide area networks (WANs)

Wireless LANs enable communications within one building or campus. Wireless LANs are self-sufficient. That is, they do not require additional services from service providers in order to operate.

Wireless WANs enable communications outside of your place of business. With wireless WANs, you can contact people or computers from almost anywhere. In most cases, interconnection in a wireless WAN is accomplished through a wireless carrier or service provider. Service provider companies charge wireless WAN users a fee for providing the transport service (usually based on the time connected or amount of data transmitted).

The basic technology trade-offs between wireless LANs and WANs are based on performance (speed) and distance (range) considerations. Generally, the shorter the range, the higher the potential for performance. Therefore, wireless LANs, which can typically transmit at distances of hundreds to thousands of feet, can operate at speeds of megabytes per second of data throughput. Conversely, wireless WANs provide transmission distances of many miles, but at generally lower data rates (typically less than 20 kilobytes per second).

WIRELESS LOCAL AREA NETWORKS (LANs)



Wireless LAN environments

Wireless LANs usually encompass a single building or a group of buildings, such as on a campus. Wireless LANs provide several benefits:

- ✓ They support short-term or interim requirements for new or extensions to the existing LANs without the need for adding cabling infrastructure.
- ✓ They may support mobile or roaming personnel, such as in a hospital or on a campus.
- ✓ They enable you to avoid the costs of a wired infrastructure.
- ✓ They provide a LAN solution in buildings where the structure previously prohibited installing a LAN (for example, in protected historic buildings that cannot be modified or in buildings with asbestos, which restricts wiring options).

Following are examples of wireless LAN scenarios.

Office

Within your office building, employees can use a wireless LAN to access information from different locations within the building, without having to return to their desks (as long as they remain within the transmission range of the wireless LAN). Wireless LANs can also be used to complement existing wired LANs.

Hospital or other medical location

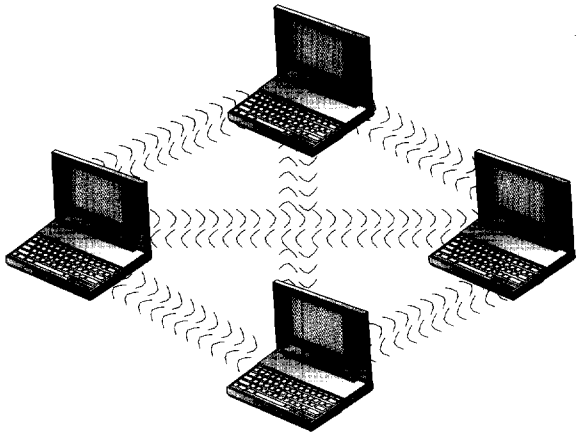
Within a hospital, physicians and clinical personnel can use a wireless computer (connected to a wireless LAN) to scan a patient's wristband and view information specific to that patient. Also, physicians can make additional inquiries as to the patient's condition or progress and prescribe medication as appropriate.

Campus or classroom

Students and teachers can use a wireless LAN for assigning or submitting homework by computer. Teachers might also send lecture notes, and students can receive them whenever they want. Wireless LAN users may be able to access information from different locations on the campus depending on their needs; for example, from classrooms, the library, laboratories, or dormatories.

Wireless LAN topologies

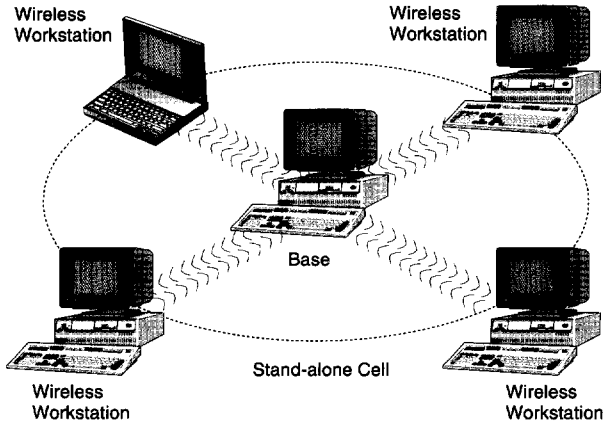
In office, retail, manufacturing, warehouse, hospital, and campus environments, people can connect wirelessly to each other. There are two types of wireless LAN configurations: peer-to-peer and base-to-remote.



Peer to peer

Peer-to-peer LANs enable the direct communication from one device to another, without going through an intermediate device. Peer-to-peer communications is especially well suited for spontaneous (ad hoc) networking, such as small, collaborative work teams. And installing peer-to-peer networks is relatively quick and easy for a small LAN.

But security and network management issues are not easily resolved with these types of LANs. Peer-to-peer LANs offer a limited range of communications and coverage. However, the range can be extended using an access point product to attach the wireless LAN to a wired LAN. The wired LAN then serves as a "backbone" link to other access points and wireless peer-to-peer LANs.



Base to remote

Another wireless LAN topology employs base-to-remote communications. These networks use wireless LAN communications to link workstations (remote) to a central workstation (base), which is at the center of the wireless LAN. Base-to-remote LANs work well for commercial uses. They can be a stand-alone LAN or a wired LAN extension, with similar capabilities and characteristics.

Base-to-remote LANs give you greater coverage and range than peer-to-peer LANs. The base unit can provide more security to LAN access and more effective management of the wireless LAN than a peer-to-peer topology.

Wireless LAN technologies

Given your environment and topology, either an infrared or radio-frequency LAN technology may be suited for your business.

Infrared

Infrared LANs transmit data, in the form of infrared light, from one wireless device to another. Infrared devices can also transmit to an "access point," which acts as a bridge to a wired LAN.

This type of wireless LAN technology is well suited for classroom environments, or for small, enclosed areas. Infrared LANs are also useful if you need to maintain a high level of network security since infrared light cannot penetrate walls. And infrared can be an inexpensive form of wireless communications.

Line-of-sight

Line-of-sight infrared transmission is a direct, laser-like transmission of light (data) from one device to another. Because the light travels in a straight line, without interference, data is transmitted and received quickly and efficiently, matching speeds of wired networks.

However, like visible light, infrared cannot penetrate walls or large structures. So each device must be "aimed" at each other to enable communications, making mobility rather difficult.

Diffused

Diffused infrared is an indirect form of light transmission. A wireless device bounces the light off the ceiling, walls, and other surfaces, causing the light to spread out across a limited area. Another wireless device can receive the diffused light and interpret the data.

With diffused infrared, the wireless devices do not need a direct line of sight with each other. But because the light is diffused, the range and performance are more limited.

Radio frequency

Wireless LANs that use radio frequency offer a greater transmission range than infrared LANs. As with infrared devices, radio frequency devices can transmit either to another wireless device or to an access point (to a wired LAN). The radio waves being transmitted can also penetrate walls, which is not a characteristic of infrared light.

Narrow band

Narrow band refers to the use of a single frequency for data transmission. This technology operates similar to radio broadcast stations. Like radio stations, you must obtain an FCC license to use the radio frequency spectrum.

Spread spectrum

Spread spectrum transmission broadcasts signals over a wide frequency band, enabling many users to coexist and use the same spectrum. In addition, the wide frequency band provides a level of security for your data transmission because the signals are hard to detect and decode. Unlike narrow band, spread spectrum broadcasts do not require an FCC license to use the technology.

There are two types of spread spectrum technologies:

- *Direct sequence* is a technique for transmitting data over a wide frequency band by combining the data with a binary spreading code.
- *Frequency hopping* is the process of transmitting signals by "hopping" from one frequency to another, sending short bursts of data at a time. This technology is a more recent development and is preferred to direct sequence transmission because of its increased robustness and interference immunity.

Wireless LAN considerations

Wireless LANs can be used for a variety of environments. To find out if this is the right solution for your business, ask yourself these questions:

- ☐ Do your employees move frequently or have a need to move periodically?
- ☐ Do you frequently require temporary or spontaneous (ad hoc) networking?
- ☐ Does your office building lack pre-existing cabling? And are installation costs high?
- ☐ Do you have a short-term lease for the building your business is in?
- ☐ Does your business have a high growth rate? Will your network be constantly changing and expanding?
- ☐ Do you need a disaster-recovery method for your network?

If you answered "yes" to any of these questions, a wireless LAN may be your solution.

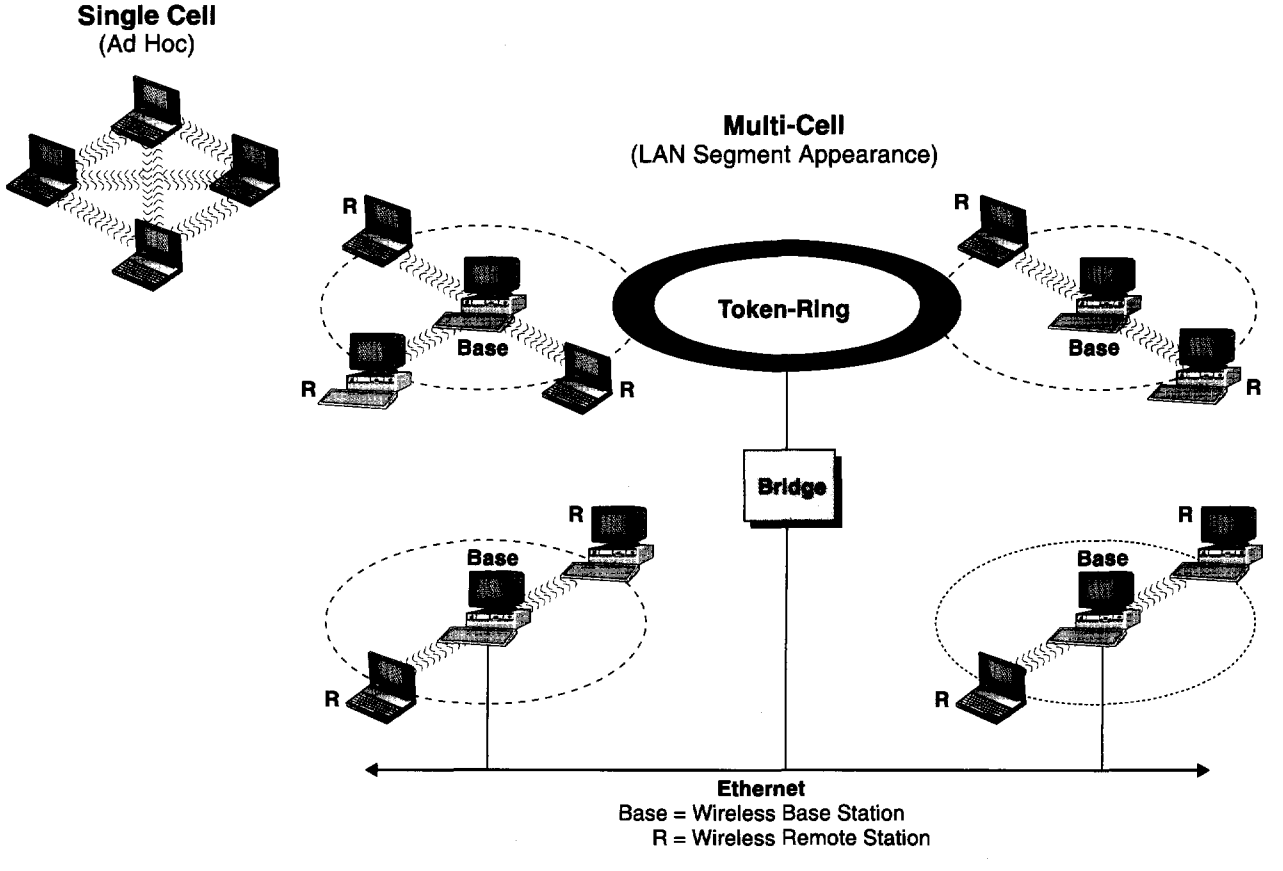
Choosing the right wireless LAN

If you decide that a wireless LAN is appropriate for your business, you need to select the appropriate topology and technology to meet your needs.

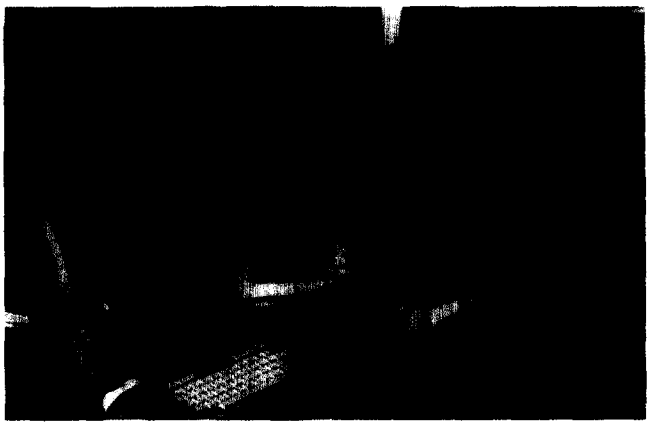
You might want to consider the following factors:

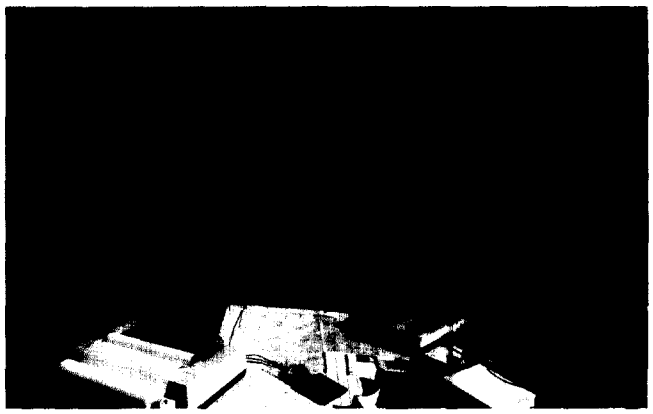
- ☐ Ad hoc networking
- ☐ Single-room LAN
- ☐ Wired LAN extension
- ☐ Security
- ☐ Network management
- ☐ Performance
- ☐ Protection from interference

For example, if you require a LAN with basic function in an enclosed room, an infrared (probably diffused) LAN with a peer-to-peer topology would likely meet your needs. However, if you need centrally controlled wireless LANs that cover multiple offices or floors, a radio-frequency or spread spectrum (frequency hopping) LAN with a base-to-remote topology could be a good choice.



WIRELESS WIDE AREA NETWORKS (WANs)





Wireless WAN environments

Consulting firm Arthur D. Little recently interviewed 500 managers and professionals and found that "41% of their time is spent in traveling . . ." (*USA Today*). These people, as well as your own mobile work force, expect to get information whenever they need it.

Today, some mobile people function in a wireless mode. At times, they have access to a wired network or are "docked" with another machine. Wireless WAN communications simply allows them to continue their work even though they might not be near a wired connection.

Here are some examples of how people are using wireless WANs today.

Mobile office

While you are traveling in a taxi from the airport to your office, you might be updating an agenda for that afternoon on your laptop. Before you even reach the office, you can send the agenda to your attendees by simply pressing a button. You can even view your e-mail. No wires, no office.

Field service and logistics

Service technicians can have pocket-sized devices that enable them to instantly pull up the service history for a customer or machine, check warranty status information, place an order for parts, or enter a job status ("in route" or "job completed," for example).

Corporate application access

The need to access existing corporate applications from remote locations is a recurring requirement for many mobile professionals. For example, many insurance salespersons need to travel to their client's location to conduct business. While away from their desks, they can simply use a portable computer to access the company's software applications. Salespersons can obtain price information, develop a contract, and even print it out while visiting the client.